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THE MIAMI CONSERVANCY BULLETIN

JULY 1920

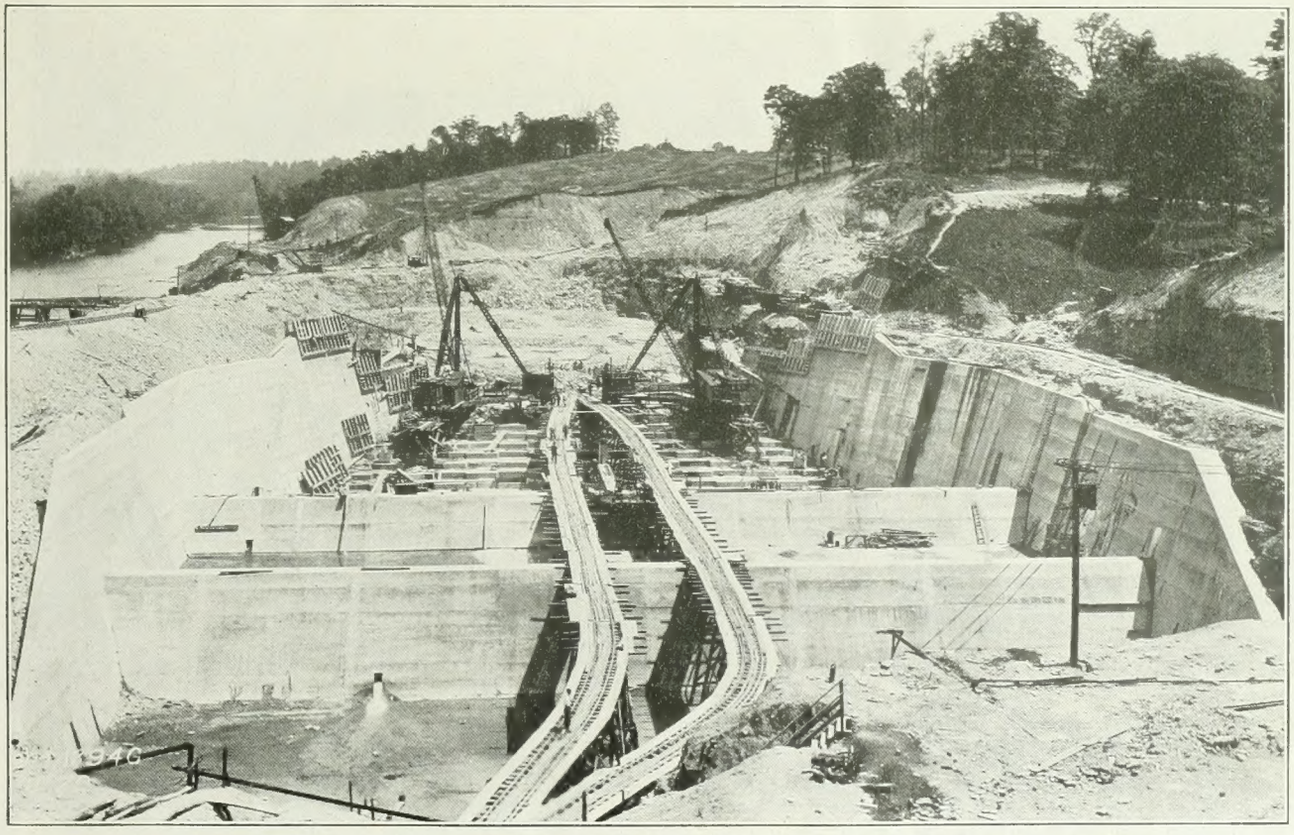

FIG. 151—DOWNSTREAM END, OUTLET STRUCTURE, TAYLORSVILLE DAM, JUNE 11, 1920.

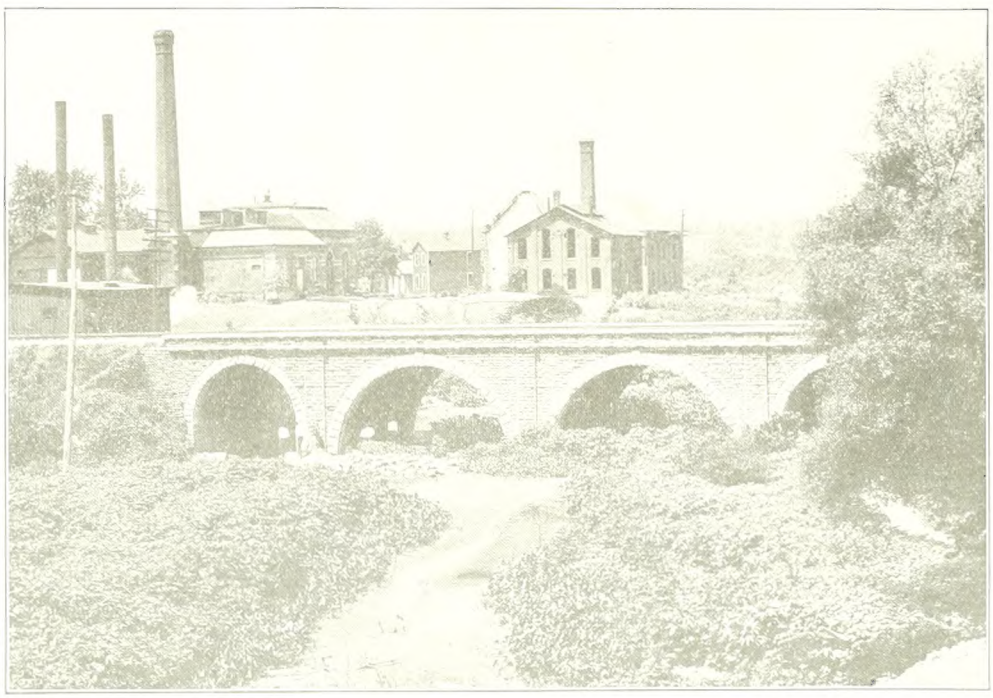

FIG. 152—STONE ARCH BRIDGE, B. AND O. R. R., HAMILTON, BEFORE WORK BEGAN, JULY 3, 1919

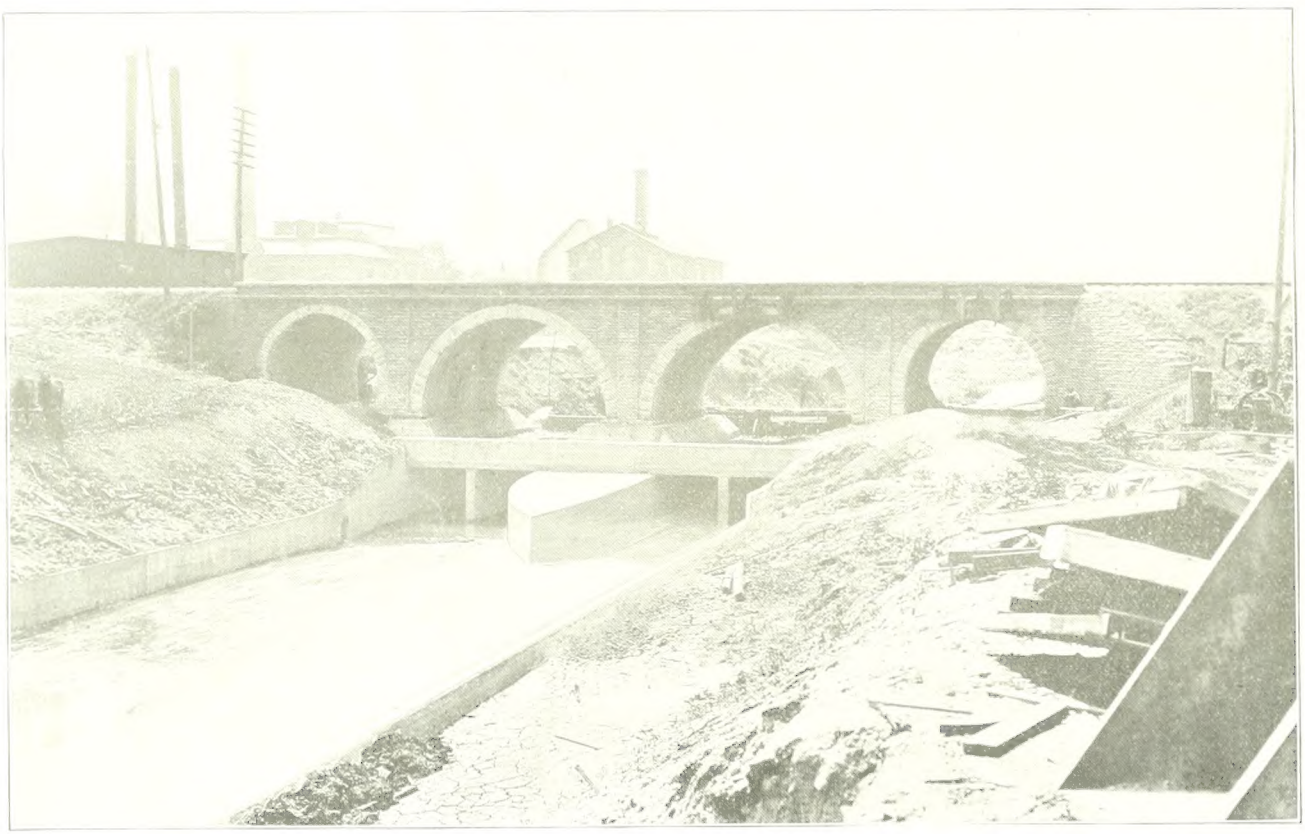

FIG. 153—STONE ARCH BRIDGE, B. AND O. R. R., HAMILTON, AFTER COMPLETION OF THE TAILRACE CONDUITS, JUNE 23, 1920.

The two pictures indicate the general nature of the construction problem involved. The stone arches were old, with some cracks and a few stones fallen out of the under sides, indicating some settlement. The foundations (on gravel), were shallow, reaching about to the top of the nearest cross wall of the conduits (in the lower picture). The tailrace from the Fordson Tractor power plant (in the foreground below), had to divide and pass under the two central arches, the bottom of its floor being about 12 feet below the bottom of the bridge foundations. The problem was to excavate to this depth to build the tailrace, without undermining the bridge piers. The conduits under the arches were roofed in order that the roof slabs might act as braces to the bases of the bridge piers. The vertical wall in the center of each conduit is to help support the roof, at some future time, when the arches will be partially filled with earth so as to provide for a widening of the bridge.

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THE
MIAMI CONSERVANCY BULLETIN
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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. Business letters should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to G. L. Teeple, Miami Conservancy District, Dayton, Ohio.

Conservancy Court Inspects the Work

The Conservancy Court met in Dayton on Thursday, July 1, and following the transaction of regular business spent about two days in an inspection trip, during which they visited all parts of the work of the District excepting the upper end of the railroad work in the Huffman basin and the work at Lockington and Troy. They expressed themselves as well pleased at the way in which the undertaking is being carried out and at the progress made.

Action was taken at the Court Session on several matters. One was the re-election of Mr. Henry M. Allen for another five year term as a member of the Conservancy District Board of Directors.

Another concerns the construction of Black Creek Bridge in Hamilton. As originally planned the District was obligated to build the abutments, but the bridge was to be built by the city, the old foot bridge which it will replace being permitted to stand in the meantime. By the change of plans now made the bridge will be built by the construction forces of the District, the cost being defrayed by the city. The change was made for two reasons. It was desired to construct the new bridge as quickly as possible on account of the danger to the foundations of the old structure in times of flood if it were permitted to remain after the excavating of the new channel by the District. Also, with the organization and machinery of the District now on the ground, it was possible and convenient for the District to undertake the digging of the foundations for the new bridge much cheaper than the work could be done by any contractor. Also the District could design and build the remainder of the structure as well. Under these circumstances it was thought both safer and cheaper to have the District proceed at once with the work of construction. Further, by construction this season, the work may be sufficiently advanced to be out of way of the river improvement next year, and thus facilitate the latter. The bridge is much needed and by the new program the public will get earlier use of it.

The second change was the introduction into the flood protection plans at Hamilton, of a levee just south of Coke Otto, extending from the east bank of the Miami to the higher ground at the M. & E. canal east of it. This levee will protect an additional area north of Hamilton, will protect the B. & O. Railroad bridge across Old River from any danger due to high water, and will also protect the highway south of Coke Otto and west of the river from danger of scour at flood seasons.

The third change is the enlargement of the river channel at Troy above Market Street, to take the entire flow in time of flood, instead of depending upon overflow lands north of the river. This involves elevation of the levee on the north bank of the river between the B. & O. Railroad bridge and a point a little north of Adams Street, to full height, a raise of about 12 feet. A street along the top of this levee is also arranged for, with a raising of the ground level back of it sufficient for building purposes. The levee on the other bank in this neighborhood is also to be raised and improved in alignment, so that the appearance of the river banks when finished will be very pleasing. This plan is

contingent on the enlarging of the Adams Street bridge by the Miami County authorities. The advantages of the changes authorized are so great that no difficulty is expected on this score.

Opening of Baltimore and Ohio Railroad Relocation

The new line of the B. & O. R. R. was opened to traffic on July 7. This line begins just within the Dayton yards and extends north for about ten miles, being necessary on account of the interference of the old line with the Taylorsville dam and retarding basin as described in the Bulletin for October, 1919. This work was begun an April 8, 1918. The grading was finished in September, 1919. The ballasting and tracklaying were finished in December, 1919, but as it was not desired to open traffic over the new line in the winter season, owing to the dangers due to action of cold weather on new ballast, the final work of dressing and lining was not undertaken until the spring of this year, work being resumed in March. The general contractor on the work was Grant Smith of New York City, who sublet the entire work to H. C. Kahl, under whom the subcontractors were the Vang Construction Company, Kahl Bros. Construction Company, Condon and Smith, McAndrews Bros., and the La Boiteaux Company. The tracklaying and ballasting were let to Roberts Bros. of Chicago. The ballast was supplied by the Conservancy District from borrow pits in the gravel of the Miami Valley bottom just below Taylorsville dam. The work was done under the direction of Albert Larsen, Division Engineer for the District, the railroad company being represented by A. H. Griffith, District Engineer, and P. A. Callahan, Assistant Engineer.

Mr. Morgan Called to Be President of Antioch College

The call to the presidency of Antioch College, recently extended to Arthur E. Morgan, the Chief Engineer of the Conservancy District, is a matter of unusual interest to all the friends of the flood prevention project. It has also a significance beyond the usual announcement of such a call. The college is in fact to be reorganized, and along lines which mark a further step in a well recognized tendency in modern education. Mr. Morgan has for a long period given much thought and attention to such matters, and it is to effect the reorganization that the call has been extended to him. He has accepted it, on the condition that active service shall begin with the completion of the work of the Miami Conservancy District; and with the further provision that his service as president shall not require the discontinuance of his engineering practice.

Antioch College is situated at Yellow Springs, near Springfield and Dayton. It was founded in 1853, under the presidency of the famous pioneer in modern educational methods, Horace Mann, who refused the candidacy for the governorship of Massachusetts to accept the job. It embodied at the time many of his ideas. It was the first college in this country to embody the principle of co-education. For many years its policy has been inclined to be rather stationary, maintaining to a great degree the traditional small college policy of the latter nineteenth century.

The new departure is in a field not exactly that of any existing institution. It will remain a small college, not attempting to compete in the peculiar field of the large universities. It will be co-operative, its students studying in the college, and working for a livelihood, by spells. The work for a livelihood will be in established nearby industries, at regular remuneration, on something like the Cincinnati University plan. But the result aimed at is different, being not to create technical experts (although graduates may well become such), but to educate in the broadest sense, the idea being that work is itself educative, and to be regarded as the application of ideas to life. Specialization will be subordinated to the inculcation of fundamentals and principles, with their application in practical arts and industries. The college course will be ordinarily six years in length, with a "book knowledge" equivalent of the usual four. The courses so far considered are Business Administration, Civil Engineering, Contracting, Education (as applied to the management of consolidated rural schools), Farming, Machine Shop Operation and Management, and Household Arts. As the last shows, the college will remain co-educational.

Seven new trustees give an infusion of new blood into the management, harmonious with the change proposed. They are C. F. Kettering, John C. Haswell, George W. Verity, F. D. Slutz, Gordon S. Rentschler, John W. Hunt and William Chryst. An acting dean will have immediate charge of affairs for the present.

Inspection Trip of the Dayton Citizens Relief Commission

An interesting incident in the progress of the Conservancy work was the visit of inspection on July 7 of the Dayton Citizens Relief Commission, as the guests of the Officers of the District. The Dayton Citizens Relief Commission was incorporated on June 25, 1914, to be the heir of the Citizens Relief Committee, the Flood Prevention Committee, and other similar bodies which had taken up and carried on the necessary work of planning and relief, following the disaster of the flood. It was this commission which raised and administered the $2,000,000 Flood Prevention Fund, which enabled the work of investigating and instituting permanent plans for flood prevention to be started, and which had charge of all such work until the organization of the Miami Conservancy District. The work of public education, necessary to the organization of the District, was in fact part of its work. On the organization of the District the Commission turned over to the latter practically all of its activities. It has always, however, kept a warm interest in the project and remained in close touch with all that has been done. It has always been the intention of the Officers of the District that after the work had progressed to the proper point, the Relief Commission should be invited to inspect what had been done and see how the trust which they had turned over to the District had been administered. The visit of July 7 was the carrying out of this plan. The dams at Taylorsville, Englewood, Germantown, and Huffman were visited, as well as the work on the Baltimore and Ohio, and the Erie and Big Four Railways, now finished or nearly so. It is a satisfaction to record the pleasure of the Commission in seeing so far advanced the work which they had done so much to set actively forward.

Building a Concrete Tailrace Below Stone Arch Bridge Foundation Level

Conduits Carried 12 Feet Below Pier Bottoms. Low Headroom Under Springing of Arches Makes Driving of Piling Difficult.

An interesting variation on this problem was encountered in the building of the tailrace for the new power plant for the Fordson Tractor plant at Hamilton. Views of the Tractor and power plant are shown in the Bulletin for September and December, 1919, the latter showing also the concrete floor of the tailrace as it leaves the power plant. Both pictures are taken from an old bridge of four stone arches, used jointly by the B. and O., and the P. C. C. & St. L. Railways as a double track bridge. It was the carrying of the tailrace under this bridge which presented the problem referred to. The bridge is old, its exact age unknown. Its appearance previous to the work is shown in Fig. 152. Cracks in the arches testify to settlement of the foundations, and a few stones which have dropped out tell the same story. As originally planned, the new power plant would supply about 1,000 horse power, taking the place of the old power plant of the Hamilton and Rossville Hydraulic Co., removed from a central position in the city to its northern limit in the carrying out of the flood prevention plans. When Henry Ford and Son purchased a controlling interest in the power plant, with the intention of using the power in driving their new Farm Tractor factory, the original capacity required to be much increased, to a full load limit of 3,300 horse power. This required such a deepening of the tailrace, to take the increased water consumed, as to carry the bottom of the new structure about 12 feet below the arch bridge foundations. With the arches in the condition described above, and with many trains on both railways passing every day, which could not be interrupted, it was necessary to exercise unusual care to keep the foundations stable, both during construction, and afterwards.

The power plant is about 400′ east of the bridge, and just north of the new Fordson plant and the north protection levee of the city of Hamilton. (See map, page 27, Bulletin for September, 1919). The head race is east of the power plant. Thus water from the head race passes through the wheels on westward into the tailrace, which passes under the arch bridge, thence curving northward and then southward to the river. From the power plant to the bridge the tailrace is an open channel 50′ wide and about 400′ long, with side walls 4.5′ high, the walls and floor being plain concrete. The walls are 3.5′ thick at the base and 1′ thick at the top. The floor is 6″ thick. This concrete channel is continued for a center line distance of about 73′ west of the bridge, after which it continues as an open channel excavated in earth, widening gradually to 80′, which width is continued to the river. No construction difficulties were encountered except those connected with passing under the stone bridge, described above. A view of the bridge before any work was done is given in Fig. 152 and after completion in Fig. 153.

The two center arches of the bridge are of 30′ span; the two side arches of 20′ span. It was planned to carry the tailrace under the bridge in two branches, one through each of the two middle arches. Each branch would then be a rectangular conduit, 20′ wide by 8′ 6″ high inside, with side walls 2′ 6″ thick, bottom 2′ thick and top 20″ thick. This would leave only 2′ 6″ on each side between the conduit and the arch foundations. Excavation showed that the latter were shallow, resting on timber grillages, which rested in turn on gravel. The bottoms, of the grillages were about 12′ above the bottoms of the proposed conduits. To keep the

The difficulty was in driving the piles, 12 feet long, the distance from the bottom of the bridge foundations to the under side of the arch near the pier being only a little more than this, leaving insufficient room to set the steam hammer on top of the pile. Fig. 156 shows the way it was done in detail. See also page 183. In general, the method was to set up nine piles at a time, interlocking as if driven, and drive the first pile part way down by means of a "stirrup" slipped over the top, the hammer playing on the foot of the stirrup. The second pile was then attached to the first by

(Continued below)

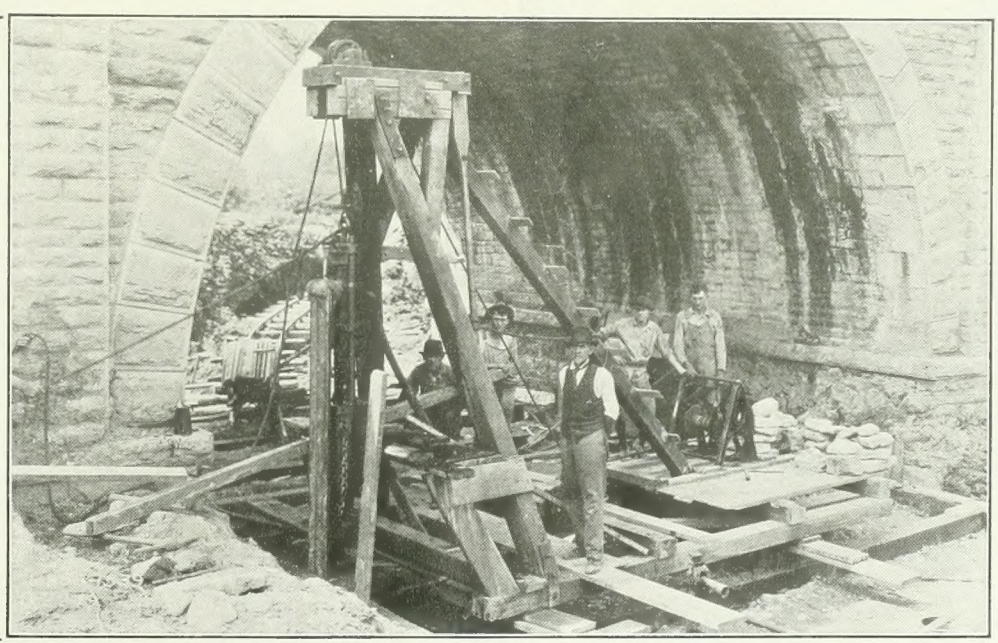

FIG. 154—DRIVING SHEET PILING FOR TAILRACE CONDUIT FOUNDATIONS, AUGUST 22, 1919

means of a pair of iron straps, and the first pile driven to full depth, taking the second pile with it to a depth sufficient to permit the hammer to work on it directly. The third pile was then strapped to the second and the process repeated.

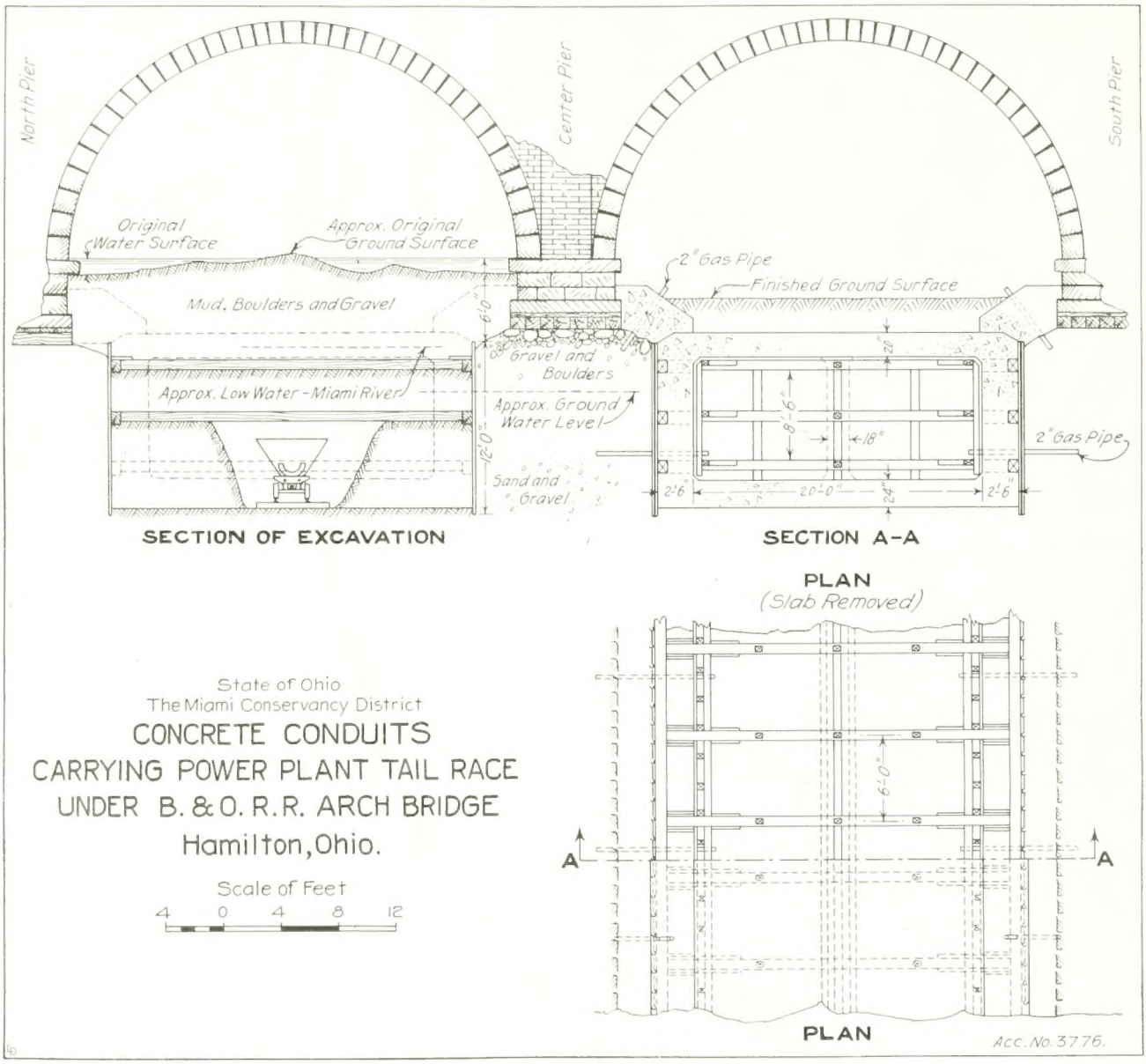

FIG. 155—TAILRACE CONDUITS UNDER B. AND O. R. R. ARCH BRIDGE, HAMILTON. PLAN AND SECTIONS

gravel under the grillages from caving, it was planned to drive a fence of interlocking steel sheet piling on each side of the proposed excavation, and as the material was dug out, to introduce bracing timbers between the two rows of piling. After the excavation the conduit floor would be cast; then the side walls, using the steel piling for the outsides of the side wall forms; then the roof. The floor and roof together would then act together as braces to support the gravel beneath the bridge piers, permitting the withdrawing of the bracing timbers.

These operations constituted the main program and were carried out as described. An additional feature was introduced owing to the desire of the railway companies to provide for a future widening of the bridge to accommodate four tracks. This would mean the extension of the concrete conduits and a partial filling in with earth of the space beneath the arches. The conduit roof as first planned would not provide sufficient strength to support this earth material. To meet this contingency, a center wall was introduced into the design, 18″ thick. This wall was poured after the roof, through holes left in the latter 12 feet apart, and of course after the removal of the brace timbers. An an additional factor of safety in the design, a concrete coping was then poured, connecting the conduit roof to the bottom of the stone arch on each side. All of these features are shown in Fig. 155.

Finally, the plan provided for the forcing of cement grout, under pressure, into the gravel beneath the bridge piers. This grout was introduced through gas pipes cast into the side walls of the conduits, at the bottom, 12′ apart. Similar pipes were cast into the copings connecting the conduit roofs and the piers, to permit air and water to escape as the grout was forced in at the bottom.

The program for the excavation is shown in Fig. 155. The upper 6′ consisted of mud and gravel, with larger stones and boulders intermixed, the latter being apparently material wasted during the construction of the arches, or placed to prevent scour. Most

of this part of the excavation was done by hand and wheel barrows. On reaching the level of the top row of timbers for the sheet piling, these were laid and the piles driven. The excavation was then continued down to the level of the second row of timbers. These were then placed and the remainder of the material removed as shown in the figure, using a steel dump car into which the material was shoveled. Some of the material, after the upper part was removed, was taken out with slip scrapers. The excavated material was dumped in heaps outside and removed by a dragline excavator which was engaged in building the north Hamilton protection levee, the latter being located just south of the bridge. This machine also dug some holes which gave dumpage ground for material after finishing its work.

The most vexatious of the minor problems was the driving of the steel piling. The difficulty lay in the lack of room to set up the pile driver, the piles being 12′ long, and requiring to be driven close to the faces of the bridge piers, where the dropping of the arch surfaces toward the springing lines gave very little head room. There was just sufficient space to set up the piles, but not enough to work the hammer. To meet this difficulty a stirrup like that in Fig. 156 was hung over the top of the pile, except that it was hung with its foot at the side of the pile instead of at its edge, the pile driver hammer striking this foot. This gave so much vibration under the impact of the blow that it was quite ineffective and had to be abandoned. The stirrup of Fig. 156 was then tried, with much better results. The first one used was too light and broke across the angle next the foot. Several trials evolved the form shown, which lasted through the job.

Driving with this stirrup, however, was found to be very slow, and other expedients were considered. The first of these was to drive each 12′ of piling in two lengths, one of 5′ and the other of 7′. By driving a 5′ on top of a 7′, and then a 7′ on top of a 5′, the short lengths would break joints, and present an interlocking wall 12′ high. The idea was abandoned, however, it being thought that the scheme would give a weakened structure, and that the joints would not be tight.

Then an attempt was made to drive a 7′ pile, draw it out and insert a 12′ in its place, driving the latter to the full depth. This scheme failed on account of the gravel falling into the hole on withdrawing the 7′ length.

Finally the scheme was tried of driving one pile about half way down, then attaching a second pile to the first, and driving the two as one. When the first was full down, the second would be half way. A third could then be attached to the second, and the process repeated. The attachment is shown in Fig. 2 of Fig. 156. It failed on account of the shortness of the link, this making the shear in the hole so great as to cut through the web of the pile. Lengthening the link as shown in Fig. 3 of Fig. 156 lessened the shearing stress to the direct blow of the hammer, or nearly so, and cured the process of this weakness.

In the plan as perfected, about 9 piles were laid on the ground side by side, interlocking as if driven, and lifted by one end into an upright position next the ranger which guided and kept the piles in place during the driving. The stirrup was then slipped over the first pile, which was driven 5′ down. Next

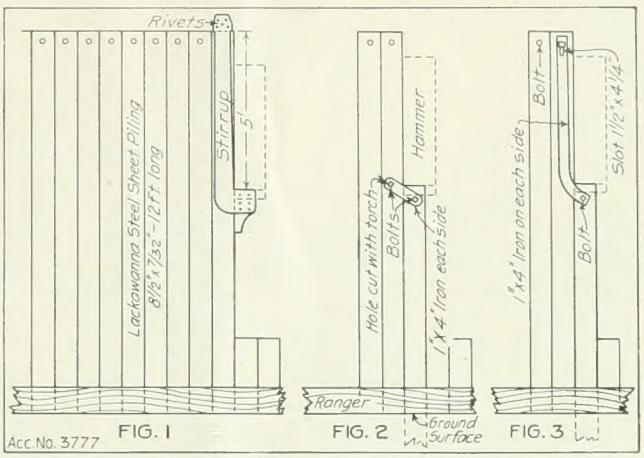

FIG. 156—METHOD OF DRIVING SHEET PILING, HAMILTON TAILRACE

the straps of Fig. 3 were applied, attaching the second pile to the first, and the first driven home. Then the straps were shifted to join the second pile to the third, and the process repeated till all nine piles were driven. A second set of nine piles were then set up as before and the process repeated. This left the stirrup to be used only on every ninth pile. The number nine was adopted as being the maximum which the crew could handle conveniently.

The driving was slow, both on account of the restricted space making the expedient described necessary, and also because of the large number of boulders encountered by the piles in the driving. Sometimes hours were necessary to get down a single pile. Sometimes 16 could be put down in the 10-hour shift. Spite of the boulders the alignment at the bottom of the piles was fairly good, although a good many blocks and wedges were found necessary in lining up the lower set of rangers. The job as thus completed was quite satisfactory.

The pile driver rig is shown in Fig. 154. It was hung from a pulley carried at the top of a tripod mounted on a timber platform which ran on rollers. The hammer was lifted and lowered by a hand winch. The pulley at the top was carried by a heavy horizontal plank which slid in guides, driven by a lever, to permit setting the hammer directly on top of a pile,, or beside it, as required in the experimental adjustment of the scheme for driving the piles by a stirrup, as above described.

Water in the excavation gave very little trouble during the progress of the work. A tailrace discharging from the old hydraulic canal formerly ran under the bridge, but this had been long out of service except to carry overflow. Old River channel, a former course of the Miami, also ran under the bridge, but it is now dry in ordinary times. Water level in the present Miami, about 1,000 feet away, stands in dry seasons about 6 feet above the bottom of the new tailrace structure, and ordinarily, the soil being mostly sand and gravel, this would have given heavy seepage. Fortunately, however, the Hamilton water works pumps take their supply from drilled wells in the gravel, only a short distance from the bridge. These pumps, in the regular course of their duty, did most of the work of keeping the excavation dry, by drawing down the general ground water level. There was, of course, some seepage, which was removed at first with steam

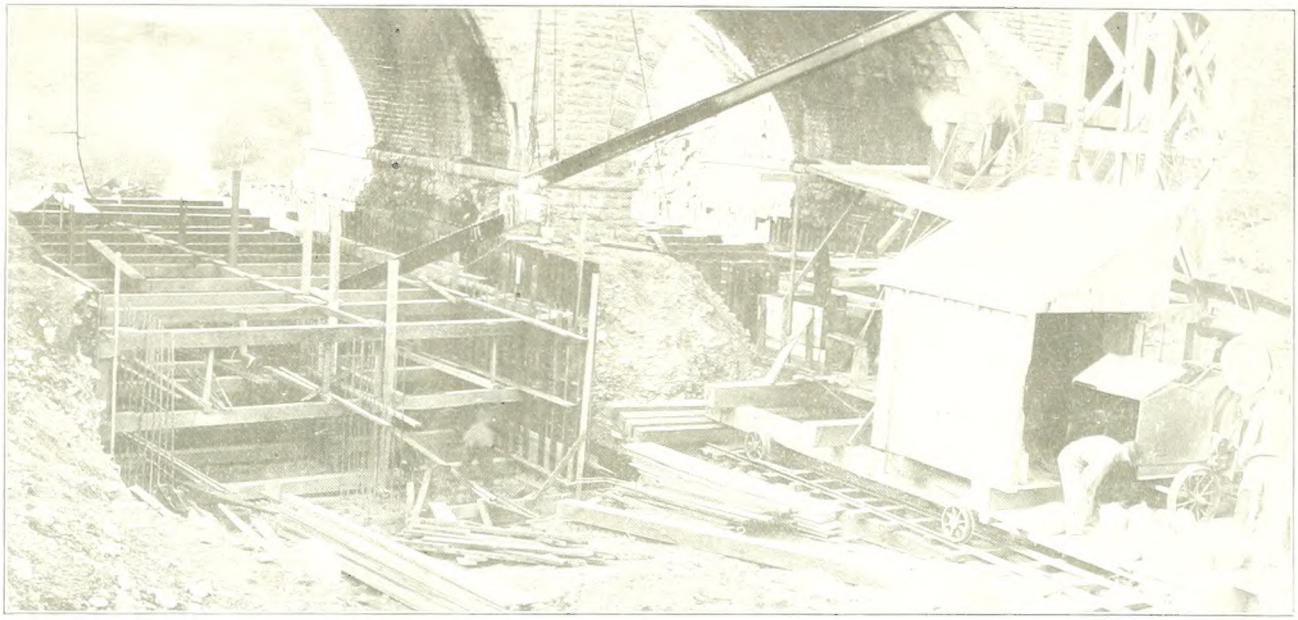

FIG. 157—CONCRETING THE CONDUITS, HAMILTON TAILRACE, NOV. 17, 1919

This shows well the shallowness of the bridge foundations, and the plan of the piling and brace timbers. The nearest pier is the central pier of the bridge. The piling and braces are in for both conduits. The tops of the piles are about on a level with the bottom of the foundation. The pile bottoms are about three feet below the third (lower) set of braces. The scant headroom above the piles to the arch ring, which made the driving of the piles so troublesome, is apparent, the foot of a pile at starting being at the level of the upper braces. The concreting plant is shown in operation at the right.

jets. These, however, gave too small discharge, and were replaced by a centrifugal steam pump. This gave trouble from excessive vibration and running normally at constant speed, it tended to pump the excavation dry, and require frequent re-priming. A Worthington duplex pump was the final solution of these troubles, and proved very satisfactory. Steam was obtained from the B. and O. pumping station near by.

The portion of the tailrace under the bridge was integral with the remainder, as described in the second paragraph in this article, and the concreting in both cases was done under contract by the F. K. Vaughn Building Co., the same firm who built the Fordson Tractor plant adjoining. The concreting plant used was the same throughout, and consisted of a mixer and tower on a platform running on rails as shown in Fig. 157. In building the twin conduits here described, the floors were poured first in about 15-foot sections. The forms for the side walls and the roof slabs were then built, and these concreted. The forms were then set for the portions of the structure which embrace the bridge piers, and connect the latter with the conduits. (See Fig. 158.) The forms for the center walls through the conduits were built, and these walls poured, after the removal of the side wall and roof slab forms, the concrete being passed through 6″ by 12″ holes spaced 12′ center to center, which had been left in the roof. The brace timbers crossing the excavation from pier to pier were boxed in, where they passed through the side wall forms, and not removed until after the side walls, floor and roof were cast; following which the boxes were knocked out and the holes they left in the side walls filled with concrete.

As a final precaution against any possible weakening of the bridge foundations by the work of building the conduits, provision was made at the request of the railroad company, for grouting any possible vacant spaces in the gravel under the bridge piers with liquid cement grout. This was accomplished by casting 2″ gas pipes into the side walls of the conduits at the bottom, 12′ center to center, extending through under the bridge piers as shown in Fig. 155. The free ends of these pipes were then connected to a compressed air tank, the lower part

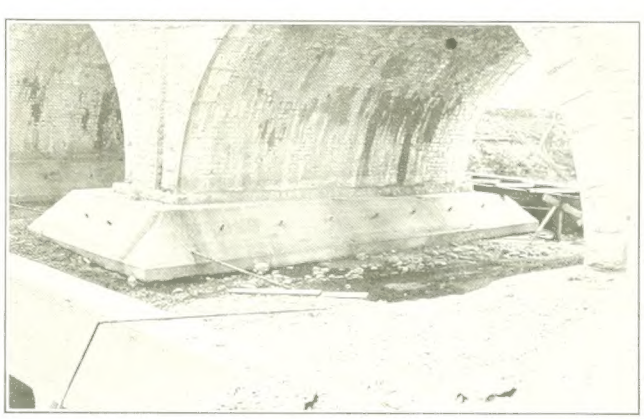

FIG. 158—CONCRETE REINFORCING BRIDGE PIER, JUNE 23, 1920

The rectangular ring of concrete seen embracing the pier, the central pier of the bridge, connects solidly with the side walls of the conduits on each side (see Fig. 155), in such a way as to act as a buttress to the base of the pier foundation. It also protects the gravel beneath from possible scour due to water in flood seasons overtopping the conduits and passing under the arches of the bridge. The gas pipes seen projecting from the concrete pierce through to the gravel beneath the pier, giving vent to possible water and air rising through the gravel as the liquid cement grout is forced in below. See pages 184 and 185.

of which was filled with the fresh grout. On admitting the compressed air to the tank the grout was forced through the pipes into the gravel under the foundations. Similar gas pipes were cast into the wall coping which embraces the bridge piers, the pipes connecting with the space immediately below these piers. (See Fig. 158). Air and water in this space, rising under the pressure of the entering grout below, would thus find vent.

With the methods of construction employed, the care which was used in carrying them out, and the behavior of the bridge piers during the work, it is believed by the engineers who were in charge that the original bridge foundations, so far from being weakened by the building of the conduits, have been materially strengthened and improved by them. There was no caving of the gravel beneath the piers during the work. No visible cracks or seams opened in the stone work. Moreover, the concrete coping which embraces the original piers, shown in Fig. 158, acts as a buttress to the bases of the piers involved, transmitting any thrust directly to the concrete of the conduit; and also acts to protect the gravel under the piers against wash from water during floods, which might pass over the conduit roof and beneath the arch. It was fortunate also, as regards the possibility of undermining, that very little sand was encountered, in the process of the excavation, which showed any tendency to run. Considerable seams of running sand might have given some trouble, but none of any consequence was encountered.

The work was carried out under the supervision of C. H. Eiffert, Division Engineer, R. B. McWhorter, Assistant Division Engineer, and W. T. Rains, Superintendent of Construction. It was under the general supervision of J. H. Kimball, Construction Engineer, in charge of all the Conservancy work of river improvement. The Inspector was G. W. Schrader.

May Progress on the Work

GERMANTOWN

During the month of May, 63,850 cubic yards of hydraulic embankment was placed, making a total to date of 563,000 cubic yards. This is approximately 71 per cent of the total hydraulic embankment to be placed.

As a prevention against scouring of the inlet channel, riprap is being placed along the slope of the right bank. Riprap is also being placed on the upstream slope of the dam from the toe to the second berm. On the downstream slope an earth surface dressing is being placed by wheeled scrapers whenever teams are available.

The contract for raising the approaches to the bridge across Twin Creek on Road No. 2 has been let to Mr. McCann. This work was started on June 3, and is making satisfactory progress.

Good progress is being made on Road No. 1. All culverts have been built and the road excavation finished. Final grading of this road is now in progress.

Mr. Daniels has been making satisfactory progress on the spillway excavation, there being about 8,000 cubic yards remaining to be excavated.

Arthur L. Pauls, Division Engineer.

June 18, 1920.

ENGLEWOOD

The hydraulic fill operations during the month have been concentrated upon the river closure. The favorable conditions for pumping at this place have resulted in an output of 145,000 cubic yards for the month of May, breaking all previous pumping records. The fill across the old river has reached a maximum height of 35 feet, sufficient to safeguard the structure against any of the small floods. On the first of June 1,280,000 cubic yards of embankment had been placed, or, in other words, the dam was 36½ per cent completed. The best record for a single shift was made on May 28, when 4,600 cubic yards were pumped through one pump in 8 hours, 48 minutes, a rate of 522 cubic yards per hour.

A large electric dragline has been engaged in building Cross Dam No. 2. This structure is nothing more than a cross slice of the main embankment, on the west side of the river, built in the dry by rolling in 6-in. layers with a large steam roller. Its purpose is to retain the end of the hydraulic fill and prevent the fluid core from flowing into the temporary spillway. The material of which the cross dam is being built comes from the adjacent excavation for the temporary spillway.

A beginning has been made on the rip rap and dry rubble paving at the inlet and the outlet of the conduits.

H. S. R. McCurdy, Division Engineer.

June 15, 1920.

LOCKINGTON

During the month both dredge pumps have been discharging material on the eastern portion of the dam, where a height of 18 feet has been attained in six weeks. Filling this part will be continued with both pumps for about two weeks, until elevation 915 is reached. This is the present height of the west part and is sufficient to care for a flood equal to that of 1913. Both parts will then be brought up together, one pump discharging on each.

A 14-in. low head pump has been installed for sluicing to the dredge pumps the material dug and piled by the dragline now working in the borrow pit. This pump will soon be in continuous operation.

The 50,000 cubic yards sluiced in the last 3 weeks, as against a previous average this year of 32,000 in the same length of time, shows an increase of 56 per cent in rate. This is due in part to an extra volume of water in the sluiceway, pumped in a continuous circuit, to be described in a future number of the Bulletin.

With the present pumping equipment a fairly wide range of pressures and nozzle sizes is now used for tearing down the material. It has been found that in the western part of the borrow pit, where stone, gravel and sand prevail, the combination of an oversize nozzle and low water pressure (about 40 pounds per square inch) is most effective. In other parts a higher pressure and smaller nozzle must be used.

The rock surfacing of the dam closely follows the fill.

Barton M. Jones, Division Engineer.

June 22, 1920.

TAYLORSVILLE

The Lidgerwood dragline is in place to start excavating the inlet channel as soon as the sluicing starts. The sluicing is still waiting for the B. & O. Railroad to move.

The concreting in the outlet works is moving very satisfactorily. Our average daily yardage for this month to date if maintained until the end of the month will establish a record for a month's work. For the week ending June 19th, we placed slightly more than 1900 cubic yards which we believe establishes a new week's record on the Conservancy work. On Friday, June 18th, we placed 518 cubic yards in nine hours and thirty minutes, having lost the thirty minutes because of motor trouble on the mixer motor. This is a new record for a single day.

At the present rate of concreting it is taking almost the entire output of the gravel plant for the concrete, so that very little is being stored for the spillway wier.

Mr. Crampton is making a fair start with his Keystone excavator on Road No. 12, north from the east end of the dam.

O. N. Floyd, Division Engineer.

June 21, 1920.

HUFFMAN

The cofferdams across the entrance and outlet channels connecting with the concrete outlet works have been taken out and on June 17th Mad River began to flow in its permanent location through these outlet works. A levee has been pumped across the diversion channel en-

tirely cutting off any flow through it. The gap between the end dam just north of the diversion channel, and the concrete outlet wall, will now be closed. By the time this is done it is expected that the Erie Railroad will be moved to its final location, so that the dam may be carried on up over its entire length.

The placing of the concrte block revetment below the outlet works has been practically completed.

The delivery of ballast gravel for the railroads has been continued during the past month. 41,000 cubic yards were turned over to them during the month of May.

Twenty-six thousand cubic yards of material were placed in the dam during the month of May. About half of this came from the stripping in the borrow pit and was put through the main pumps. The balance was sluiced from the hill at the north end of the dam. Although the output from this latter plant has not been large the results have been very gratifying. A large percentage of the material is being worked out into the center pool in the dam to form the clay core. This core pool has sealed up to such an extent as to reduce the seepage away from it from about 6,000 gallons per minute to practically nothing. This hillside borrow pit has opened up better than expected, as we find in places a thicker layer of clay on top of the rock than we had even hoped for.

The work on the relocation of the Valley Pike has been completed except a short section where it passes through the sluicing borrow pit. The surfacing of the Springfield Pike, from the south end of the dam to where it joins the present road south of the railroad cut, has been completed.

C. C. Chambers, Divison Engineer.

June 23, 1920.

DAYTON

Dragline D-15 began operating June 5, after having been under repairs since it was wrecked by the high water on April 21. It is now working on a relocation of the 10-in. high pressure gas main which crosses under the bed of the river about 2,000 feet down stream from Washington Street. D-16 and D-8 are working on channel excavation above Third Street. D-19 is building a coffer dam for lowering the 20-in. water main near McKinley Park.

The South Robert Boulevard Wall is 77 per cent completed, 3,410 cubic yards of concrete having been placed to date.

Work on Stillwater Drive Wall, extending easterly from Main Street Bridge, has been started. The greater part of the necessary excavation will be performed by the Finke Engineering Company, working under contract. The work was started June 5.

Revetment work by Price Brothers Company has continued. Concrete is now being placed along the north bank of Mad River downstream from Webster Street. Pile driving is under way along the south bank of Miami River below its confluence with Mad River.

To date 21,000 cubic yards of sand and gravel have been issued from the gravel pit.

Channel excavation to date amounts to 830,800 cubic yards. The pay quantity in spoil banks and levees is 564,600 cubic yards. Levee embankment amounts to 75,500 cubic yards, including 60,000 cubic yards on Contract No. 41. In accomplishing this work the total yardage handled amounts to 1,435,500 cubic yards. These figures do not include 82,000 cubic yards excess excavation for the launching basin and scowing canals.

C. A. Bock, Division Engineer.

June 21, 1920.

HAMILTON

The electric dragline, D-16-18, has been working on channel excavation north of the railroad bridge, placing the material in the east levee. About 400 feet of levee slope and river bottom have been made ready for the concrete revetment.

Dragline D-16-17 has completed the excavation and pile driving for the east abutment of the Black Street bridge, and is at present working on the excavation for Pier No. 3.

The Marion dragline, D-16-20 is continuing the work of grading for the loading track on the west side of the river from the trestle to the Main Street bridge. It has also loaded cars with gravel for Price Brother's concrete block plant.

Concreting has been completed on the four main walls at the Main Street bridge with the exception of a part of the coping on the northwest wall.

Excavation has been started on the Black-Clawson wall. This work is being done with a stiff-leg derrick, mounted on car trucks. These car trucks were part of the 1913 flood wreckage dug out of the river by the dragline.

Price Brothers have completed driving the piling for the trestle at Station 110.

The total number of blocks manufactured to date by Price Brothers is 40,000. The total requirement will be 225,000.

The total amount of item 9, channel excavation, to June 1, was 691,400 cubic yards.

C. H. Eiffert, Division Engineer.

June 20, 1920.

LOWER RIVER WORK

Miamisburg. During the past month the Bear Creek Road fill at the point of its crossing with the east and west levee has been completed and the road will be opened to traffic in a few days. This road has also been brought up to the present height of the levee just east of the twine factory. Trestle for the construction of the levee and road between the upper Germantown Pike and the Groendyke spur track is ready for use and work on this fill will start soon.

Franklin. Jeffrey, Boorhem & Co. are working on the strip of levee which extends from Miami Avenue to the gravel pit near the C. N. R. R. They have constructed 500 lineal feet of levee in the past five days and will probably finish this strip in about two weeks. The Miami Avenue road over the levee has been constructed and is now open to traffic.

Middletown. Cole Brothers are now ready to move material for the levee between Fifth Street and Sixth Street with the narrow gage train outfit. They have two locomotives and twenty 4-yard dump cars. The length of haul is about 1,200 feet. The material will be dumped from trestle which is now being constructed.

The C. & C. Haulage Company has completed the fill along Hydraulic Street between North Main Street and the bridge over the M. & E. Canal at Tytus Avenue. They are now constructing a portion of the levee along the south bank of the canal from the bridge mentioned above to Milburn Avenue, connecting at this point with the levee completed by Cole Brothers. The material they are using is gravel, but this will later be covered with top soil.

F. C. Blackwell, Assistant Engineer.

June 18, 1920.

TROY

During the last month the dragline has continued excavating from the cut-off channel and has wasted the material on the left bank. The pay excavation from May 15 to June 15 amounts to 25,900 cubic yards, making a total of 81,500 cubic yards excavated from the channel to date. The length of completed channel is 3,400 feet.

The lower end of the channel was completed on June 8, and since then the dragline has moved to the upper end of the channel cut and has been undergoing repairs. As soon as repairs are completed the dragline will again excavate from the right side of the channel and place the excavated material in the levee embankment.

C. F. Griffin, Assistant Engineer.

June 15, 1920.

RAILWAY RELOCATION

Big Four and Erie—The ballast on the Big Four and Erie is 85 per cent complete. Practically all of the ballast has been distributed and the track raised up to its final position. Walsh Construction Company's forces have started dressing up the ballast.

The signal work at Tates Point and Fairfield is nearing completion. The ground work is almost complete and the line work has been started. The Western Union have the telegraph line about 90 per cent complete. The fences on these railroads are practically finished.

The Westwood Park underpass is completed and the backfilling and grading for the road approaches is in progress. The District forces are doing this work.

Baltimore and Ohio Railroad—The Baltimore and Ohio Railroad is now operating on the new relocated line. The station at Taylorsville is finished. The new line is then complete, with the exception of some 6,000 cubic yards of excavation to finish embankment which it was impossible to place because of the proximity of the old track. This is about three miles south of Taylorsville. Some crossing signs, etc., will also be constructed, as well as some short stretches of fence left unfinished because

of the new right-of-way being too close to the old railroad.

Ohio Electric Railway—The Walsh Construction Company started ballasting on this line June 18.

The construction of the pole lines for the trolley system is 50 per cent complete. This is being done by the District under Mr. Frank Harvey's supervision.

Albert Larsen, Division Engineer.

June 25, 1920.

RIVER AND WEATHER CONDITIONS

The river and weather conditions throughout the Miami Valley were comparatively normal during the month of May. No unusual storms and no freshets of any appreciable size were noted at any of the stations. At the District's stations the total rainfall for the month varied from 1.86 inches at Fort Loramie to 4.19 inches at Pleasant Hill. At Dayton the total amounted to 2.71 inches, or 1.17 inches less than normal.

Observations taken by the U. S. Weather Bureau at Dayton show that the mean temperature for the month was 60.6 degrees, or 2.0 degrees less than normal; that there were 14 clear days, 9 partly cloudy days, 8 cloudy days, and 9 days on which the precipitation amounted to or exceeded 0.01 of an inch; that the average wind velocity was 10.3 miles per hour, the prevailing direction being from the northeast; and that the maximum wind velocity for five minutes was 40 miles per hour from the north on the 23rd.

Ivan E. Houk, District Forecaster.

June 25, 1920.

Measuring Upward Pressure Under Island Park Dam, Dayton

Hydraulic Gradient of Seepage Water Through Gravel Under Dam Determined by Means of Gas Pipes Carried Up Through to Dam Apron.

A dam built upon porous material, like that at Island Park, where the dam foundation is mingled sand and gravel, permits unavoidably a slow creep or leakage of water through the porous material under neath the dam, the pressure producing the creep being measured by the difference in the water level above and below the structure. Half way across the underside of the dam, this pressure would be reduced one half, in the simplest case, and the same water pressure which produces the creep, also exerts an upward pressure on the under side of the dam. To reduce this leakage it is common to drive a tight fence of "sheet piling" into the gravel at the upstream and downstream edges of the structure; and also to build "cut-off walls" projecting downward from its under side at chosen points. At Island Park both these expedients were adopted. See Fig. 161). The theory is that the creeping stream of water follows the surfaces of the obstructions, down one side and up the other, and along the under side of the structure itself. Thus the sheet piling and the cut-off walls are supposed to act to increase the distance the water must travel through the porous material by double the depth of each obstruction. That is the theory used in calculating the creep or leakage under a dam, and also in calculating the upward pressure beneath the dam affecting its stability.

In point of fact, this theory, while proper enough when used with a proper "factor of safety," concerns an action not fully understood, and to which it has not been easy to apply in a finished dam, the test of actual measurement; and it was to remedy this lack that the engineers of the Conservancy District installed the simple apparatus described below, during the process of construction.

The apparatus was simply a series of 1-inch gas pipes, built into the concrete of which the dam is constructed, extending from various points at the under surface of the dam, up through it to the air above, the lower ends being open, but tied round with a burlap bag of coarse gravel, to prevent clogging. See Fig. 161, where the lower ends of the pipes are numbered "1," "2," "3," etc., and the bags are indicated. At the upper end each pipe terminated in a short vertical length open at the top. For convenience all the pipes were led through the structure to the flat apron below the dam crest, where the upper ends were easily accessible. Remembering that the water, which is flowing at all times over the dam crest, is also seeping slowly through the saturated gravel beneath it, it will be seen that the seeping water will rise in each pipe till it reaches a height sufficient to balance the pressure under which it is flowing at the pipe's lower end. This height can be easily measured by inserting a stick in the open top of the pipe till it reaches the water surface. The pressures will vary with the heights of these water columns in the several pipes. The greatest will naturally be at the upper edge of the dam, at "10," where the pipe might naturally be expected to be subjected to the full head of water above the dam. The least will be at "1," next the tail water below the dam. Intermediate points will give the pressures just below and just above each fence of sheet piling, and each cut-off wall; and in the middle of the long level space at "2." Having the measures at these points, we have determined thus by actual test whether the creep of the water under the dam corresponds with the theory outlined above.

The heights of the several water columns in the pipes "1," "2," etc., are indicated by the small circles "a," "b," "c," etc., immediately above those points, as measured during the tests. Several measure-

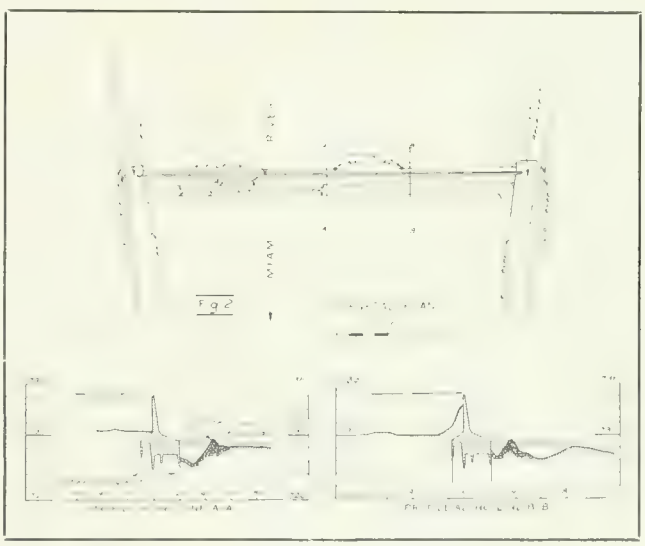

FIG. 159—PLAN AND PROFILES, ISLAND PARK DAM, DAYTON

It is an overfall dam, of concrete, with gravity section. The pipes used in the tests were installed along the lines "AA" and "BB." The profiles are along these lines. The foundations are on sand and gravel with a slight intermixture of clay. Borings were made as indicated in the plan.

line" (or more often the "hydraulic gradient"), we get a diagram of the drop in pressure under which the water flows, as it seeps from the upstream to the downstream limit of the dam, through the gravel. Two lines are in fact shown, a dotted and a full line, urements. They are so close together that they may be considered as one.

open below into porous gravel, that the pressure at "10" would be equal to the full depth of the water from "10" up to the surface of the water flowing over the dam. In fact, this pressure is only that from "10" up to the small circle at "k." The reason for this is that the pipe at "10" was protected from the full pressure of the water above it by a blanket of mud which had been deposited on the bottom of the pond above the dam during the period between the building of the dam and the taking of the measurements, this period being about two years. This "plugged" the porous gravel, to a great degree, stanching the seepage flow. The head of the water above "10," from the surface down to the small circle at "k," was occupied in forcing the water through the mud blanket, leaving only the drop along the piezometric line, from "k" to "a," to force the water through the gravel beneath the dam.

It is to be regretted that the measurements of pressure could not have been made immediately after the dam was built, thus furnishing a means of comparing conditions when the porosity and seepage were greatest, with those existing after the in 1917, the active entry of America into the war made this practically impossible.

Nevertheless, the measures do tell something as above. Without a mud blanket, the piezometric along the under side of the dam, according to this the blanket, according to theory, it is the line "p" to "n." Actually, as measured, with the blanket, it is the line "k" to "n." The discrepancy is manifest. The theory is not backed by the facts in this case.

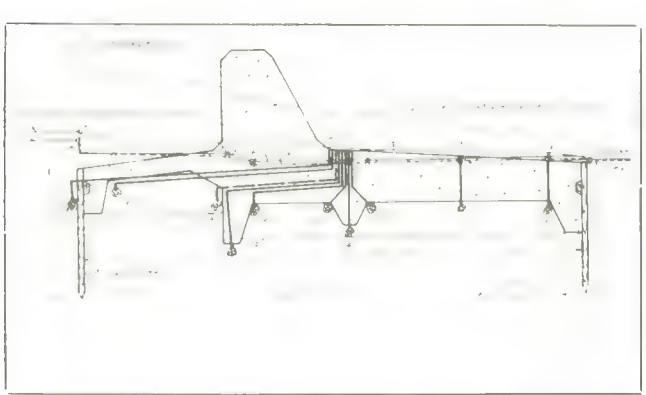

FIG. 161—SECTION SHOWING PIPE INSTALLATION ALONG LINE AA, FIG. 159

FIG. 160—ISLAND PARK DAM AT LOW WATER

Note the gravel shoal about 20 feet downstream from the dam apron, deposited from erosion just below the apron, where originally there was about two feet of stone riprap. Most of this was washed out and piled in the ridge seen. Compare profiles in Fig. 159. The water cushion and the sheet piling have protected the apron from undercutting. Slab concrete revetment of east levee is seen in the distance. Taken June 21, 1920.

In fact, the "line of creep" theory is scarcely more than theory, and appears to be applicable only in a general way. The pressure falls from the upstream to the downstream side of the porous materials, but not in strict proportion to the distance as measured along the under side of the structure, especially if this is interrupted by cut-off walls and sheet piling. Sand and gravel, the usual porous materials, generally occur in more or less horizontal beds, interleaved and overlapping. Some of these are much more porous than others, according as they are free from clogging with clay and silt. The flow of water through these layers under a dam tends to be horizontal, following the more porous layers. The value of sheet piling is not so much in lengthening the line of flow by compelling the water to go up one side and down the other, as in shutting off the horizontal flow through a more or less open stratum, and compelling the water to go down through a layer or layers more impervious and resistant. Once below one of these, little of the flow will again rise to take the theoretical "line of creep" along the under side of the dam, and in these cases the law of proportionality fails.

It is true that "water blisters," and even "air blisters," such as not infrequently occur between the under surface of a concrete dam and the materials it is built on, make these spots peculiarly vulnerable to the flow of water, and this favors the "line of creep" theory. Nevertheless, the facts adduced above make it more often probable that the major flow is carried below the dam bottom through a considerable thickness of a lower stratum.

The piezometric line on the diagram in Fig. 161, taken from the experiments at Island Park, bear out the above. The portion from "f" to "a," for instance, is horizontal, indicating that there is no flow whatever along the dam bottom between these

points, but a condition where the water is trapped and stagnant. The flow seems to be from "A" to "B," along some stratum underneath, with a connection to the stagnant space at some point near the downstream sheet piling.

The greatest value of these experiments is in the proof they supply as to the efficacy of an upstream blanket of mud and silt in reducing the upward pressure acting to endanger a dam, when built, as dams must sometimes be, on porous strata. The proof came when the mud blanket next the pipe at "10" was removed, and the full water pressure allowed to reach that point. This was accomplished by lowering a fire hose nozzle under about 75 pounds pressure under the water, and directing the issuing stream against the mud at the bottom, washing it away and permitting direct pressure to reach the pipe end. The water in the open end of the measuring pipe on the dam apron immediately rose to practically the level of the headwater above the dam crest.

It was notable, however, that the water level in the other pipes was not affected by the change. This was to be expected. The area of mud blanket cleaned away by the nozzle was apparently small and the flow through it was so diffused before reaching the bottom of the sheet piling as not to appreciably affect the pressure beyond it. Moreover, the gravel layers below the end of the pipe at "10" may have been clogged with mud before the mud blanket formed, and these layers prevented any increased flow. Or there may have been a partially or effectively impervious stratum of the original material below "10," which the sheet piling forced the flow to penetrate, thus blocking the transmission of pressure as soon as the piling was driven. Observations immediately following the building of the dam would help in determining some of these points. In any case, the efficacy of the mud blanket itself was demonstrated beyond doubt, and points to the desirability of the introduction of this feature (by means of rolled fill or otherwise), as an additional factor of safety in dams built on porous material.

An interesting feature of the investigation was the discovery that considerable quantities of gas were accumulating beneath the dam, especially at the end of the pipe "9," where the shape of the under surface caused it to act as a gas holder. "In a period of about a month between observations gas had collected so that the flow from a ¼-inch nipple connected with this pipe was sufficient to maintain a flame about a foot high for ten minutes. The gas was evidently methane, generated by the decomposition of slight quantities of vegetable matter in the gravel." This gas evidently increased the tendency of the dam to float—that is, increased the upward pressure on its bottom; a fact which should be considered in some cases in dam design.

The investigation was carried out by E. W. Lane, Assistant Engineer with the District, and E. L. Chandler, Assistant Division Engineer on the Miami River improvement through Dayton. In the original installation of the apparatus in the dam, Mr. Lane collaborated with B. M. Jones, whose transfer to be Division Engineer at the Lockington Dam made his further participation in the enterprise impossible. It is believed that the investigation has a distinct value along the lines indicated, and it is to be hoped that further work of the same nature may be done, inasmuch as the apparatus can be very simply and inexpensively installed during the work of construction of a dam or similar structures. The effect of cut-off walls and sheet piling, and of the porosity of strata located by test pits and borings made in the regular progress of the preliminary study of the site, can be determined by such tests in a way to put the problems of design, in these matters, on a more exact foundation.

Engineers wishing to know more of the details of the investigation herein described are referred to an article by Messrs. Lane and Chandler in the Engineering News-Record for May 20, 1920.

The new channel is 4,000 feet in length, and cuts off a wide bend in the Miami (part of which can be seen at the right), thus increasing the velocity, giving increased discharge in flood seasons. The present bed of the new channel is 40 feet wide. It is expected, however, that the action of the river will be the same as it has been at Middletown, where is was depended on to increase the width of the channel by the water's own erosive power. This increased width was scoured out at Middletown within a

(Continued below.)

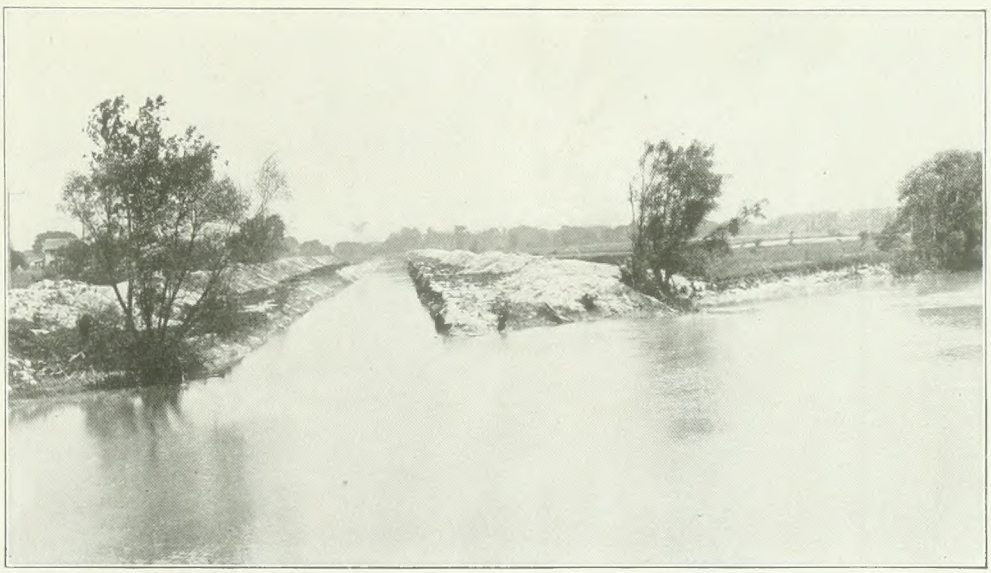

FIG. 162—THE NEW CUTOFF CHANNEL BELOW TROY

period of a few months. In both cases the first excavation was done by a dragline excavator. The work here shown is just below the city limits of Troy. Improvement in the flood prevention plans through the city of proper, recently authorized by the Conservancy Court, are noted on the editorial page.

Stability of Conservancy Dams

The importance of stability in dams like those of the District, and the care which is being exercised in making certain that such stability is secured, have been several times mentioned in these columns. The pictures on this page are shown in proof of the fact that these efforts have had their due effect. They show two excavations in the material of the sand and gravel embankments which enclose the impervious core material of the Englewood dam. These embankments are composed of the materials deposited on the beaches in the process of hydraulic fill, as described in the Bulletin for February, 1920. Fig. 164 shows an excavation made in the outer edge of the Englewood beach in order to build the concrete walls of Sump No. 3. (See Bulletin for June, 1920, p. 166). Fig. 163 shows excavation made within thirty feet of the core pool (which may be seen beyond the excavation, at the left), for another purpose. In Fig. 164 the wall of the excavation stands nearly vertical, as is evidenced by the shovel standing against its base. There seems to be just enough clayey silt intermixed at this point to make a binder, producing a "cemented gravel." This, of course, is an aid to the stability.

In Fig. 163 there seems to be no such cementing material, the sides of the hole showing what seems to be almost pure sand and gravel. Still, at its upper part the bankside stands at a very steep slope. In both cases, the material, even at the bottom, is perfectly dry, although in both cases the water in the pool is ten or more feet above the level of the bottom of the excavation, and in Fig. 163 is only thirty feet away. This is an evidence of the perfect drainage afforded by the two embankments enclosing the dam core.

FIG. 163—STABLE GRAVEL SLOPE IN DAM EMBANKMENT, ENGLEWOOD, TAKEN APRIL 7, 1920

FIG. 164—STABLE GRAVEL WALL IN DAM EMBANKMENT, ENGLEWOOD. TAKEN MARCH 5, 1920.

The facts noted should be considered in connection with the facts as to the relative thickness of the enclosing embankments, as compared with the core, brought out in the February article above referred to. The core constitutes only one-fifth to one-sixth of the total dam thickness. Even if quite plastic, the danger of its breaking through such relatively thick embankments, as has sometimes happened in imperfectly designed earth dams, will be very slight in the Conservancy dams, due to the high stability of the embankment materials just noted. Taken in connection with the evidence afforded by the pressure-cells as to the rapid stabilizing of the core itself (as given in the Bulletin for March, 1920), the pictures give highly satisfactory proof as to the efficiency of the Con-

servancy dams at the point where there has in some quarters been most question—the matter of the stability of a hydraulic fill dam as affected by the temporary plasticity of its core materials.

Direct observations on the core materials at various depths are in contemplation which will set this matter still more conclusively at rest. A further discussion of the subject will be published later.

MIAMI CONSERVANCY

INEXHAUSTIBLE FARMS

FOR SALE

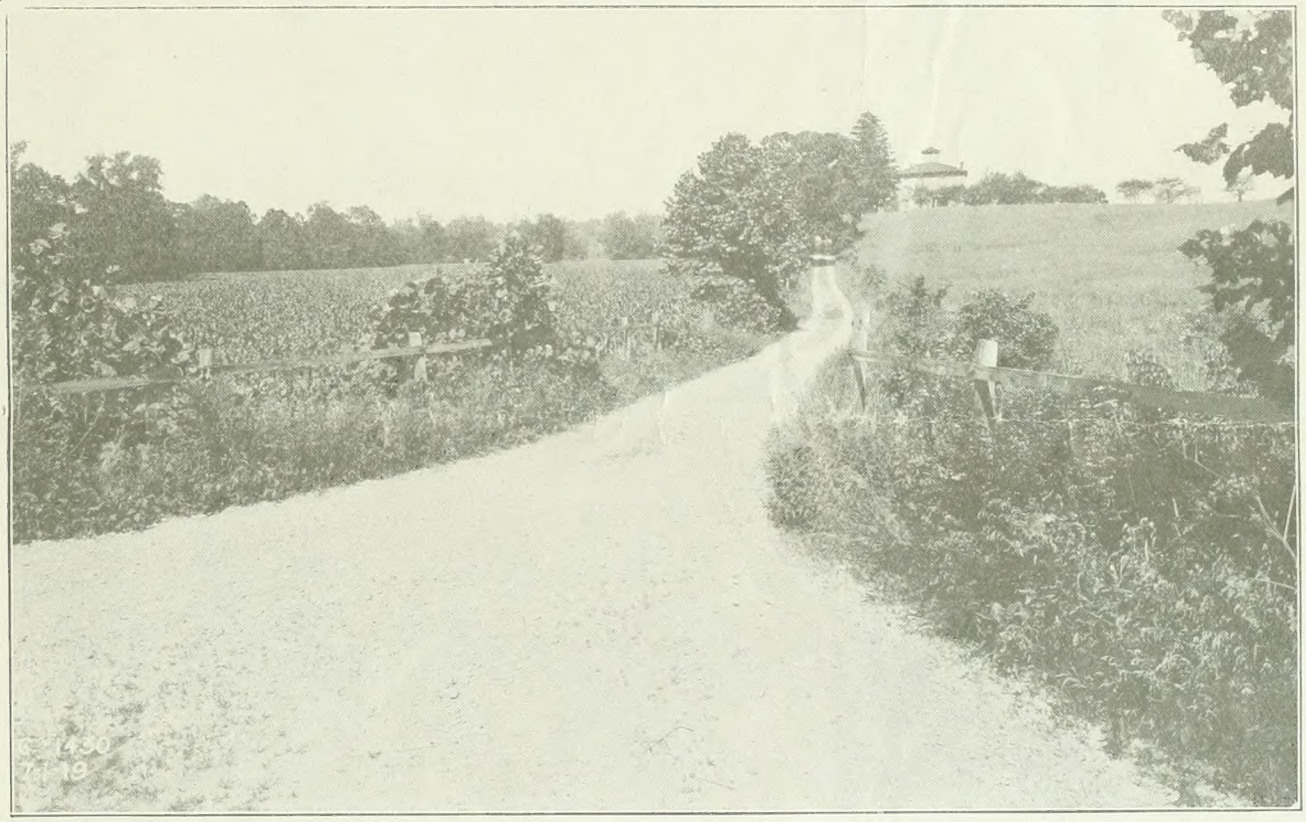

FIG. 165—FIRST AND SECOND BOTTOM LANDS, GERMANTOWN BASIN, JULY 1, 1919

Rich Corn Farms, Kept Perpetually Fertile by Alluvial Deposits.
No Manure or Fertilizer Necessary.
No Pioneering—These Are Well-Improved, Going Farms.
In One of the Richest River Valleys of the Middle West.
Fourteen Steam and Electric Roads Run Through It.
Nine Flourishing Cities (Populations from 4,000 to 153,000), Furnishing Near-by Markets.

Address Office "F"—Miami Conservancy District, Dayton, Ohio

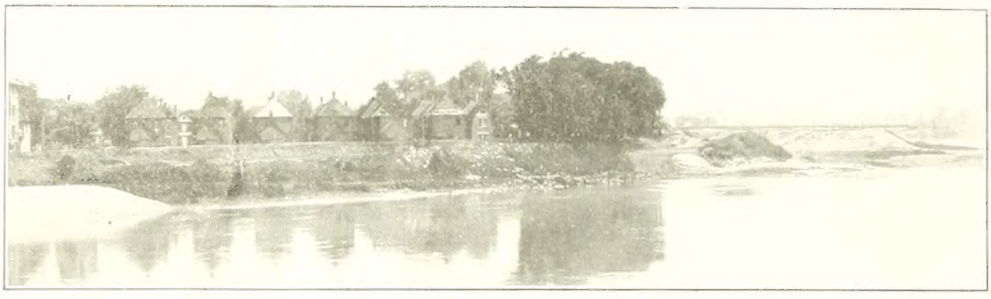

FIG. 166—HOUSES TO BE WRECKED FOR DAYTON RIVER IMPROVEMENT

The houses to be wrecked are the three at the right

Records Broken at Taylorsville

The picture shown in the frontispiece at Fig. 151 shows a late stage of the concrete outlet works at Taylorsville dam. The past month has seen notable progress in this work. Records have been broken in the amount of concrete placed in a day, in a week, and in a month. The day's record was 522 cubic yards, made on June 18. The highest previous record was 374 cubic yards, made at Lockington. It is worth noting also that the high day's record at Taylorsville was preceded and followed by excellent days records and was not the result of any careful piling up to achieve a summit. The week's record was 1890 cubic yards. The month's record (June) was 7026 cubic yards, as against a previous month's record of a little under 6100 cubic yards, made at Huffman. The total of concrete to be placed at Taylorsville is 55,000 cubic yards, much the greatest at any of the dams. The program for the year is 48,000 cubic yards, which it is expected will be finished, at the present rate of progress, by November 1. This will enable the Miami River to be turned through the outlet works and the river section of the hydraulic fill to be started. Details regarding the concrete work at Taylorsville were given in the Bulletin for March, 1920.

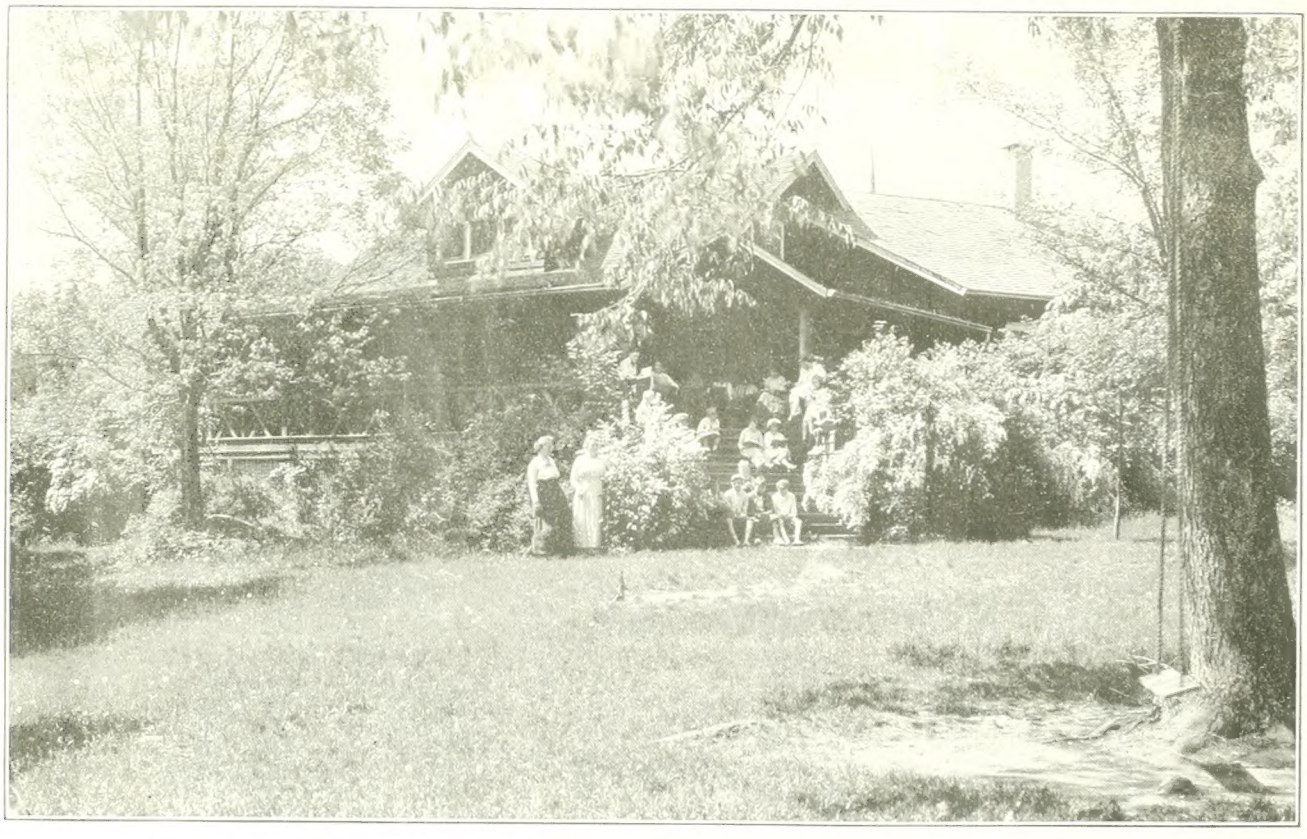

FIG. 167—CONSERVANCY SCHOOLHOUSE AT ENGLEWOOD CAMP, JUNE 19, 1920

This house was formerly a summer residence in the woods on the western slope of the Stillwater River, a short distance above the Englewood damsite, and was one of the properties necessarily acquired by the Conservancy District on account of its situation within the boundaries of the flood retarding basin. Being adjacent to the Englwood Camp, and capable of being converted into a schoolhouse for the children, it was used for the purpose. It is one of four schoolhouses, at as many camps, which it was deemed advisable to establish in order to furnish the necessary educational facilities for the children of the employees.